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Pest

A CURCULIONID WEEVIL
Naupactus xanthographus (Germar)

Order: Family

Coleoptera: Curculionidae

Nomenclatural
Note

The generic placement of N. xanthographus has not achieved stability, and the combination used here remains subject to change. Some authors use the combination Pantomorus xanthographus; most use Naupactus xanthographus. O'Brien and Wibmer (1982) resurrected the long disused but senior name Alceis Billberg 1820 to replace the commonly used Naupactus Dejean 1821 (or Naupactus Schoenherr 1833). However, O'Brien and Wibmer (1984) later separated Naupactus as distinct from Alceis. Species compositions of these genera are unsettled.

Economic
Importance

The four members of the N. xanthographus group here distinguished as species or species complexes are sufficiently similar to one another to be confused in the agricultural literature, and they probably share critical biological attributes of potential quarantine significance.

Naupactus xanthographus has notably high pest potential for North American agriculture. It is a pest of several major crops, especially grape and tree fruits, that are grown in North America. It has a primarily temperate rather than tropical distribution; Buenos Aires and Montevideo represent the general regions from which several South American weevil species (including the vegetable weevils, Listroderes spp., and the whitefringed weevils, Graphognathus spp.) probably entered southeastern North America. The weevil is immigrant in Chile, so Chilean populations should be adept at colonization; Chile should be a prime source area for immigration into western North American agricultural regions. Live adults have been intercepted at North American ports in multiple numbers. Most important, an inseminated female may retain viable sperm

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for as long as 4 months (González 1983). González considered N. xanthographus of prime quarantine importance for fruits exported from Chile.

In Chile, N. xanthographus adults feed on grapevine shoots and leaves and are particularly injurious to young plants. Adults also injure table grapes by leaving a deposit that is difficult to remove. Extreme damage is done by larval feeding in the root systems, with irreversible damage to primary and secondary roots. The weevil can live on more than 50 plant species, including potato and alfalfa as well as fruit crops. Although considered a minor pest elsewhere in temperate South America, its importance to Chilean agriculture grew dramatically during the 1960's, and by 1970, it had become a major crop pest there (Olalquiaga-Faure and Contesse-Pinto 1959, González 1980).

Quarantine significance to U.S. agriculture of the other three members of the N. xanthographus group is probably comparable, at least in subtropical areas of Florida and California. Additional notes on these species are included below. Personnel using this article should be on the alert for all members of the N. xanthographus group. (See Characters.)

Hosts

Hosts of N. xanthographus include Annona cherimola (cherimoya), Citrus spp. (including lemon, orange), Eriobotrya japonica (loquat), Foeniculum vulgare (fennel), Juglans regia (walnut), Malus sylvestris (apple), Medicago sativa (alfalfa), Mespilus germanica (medlar), Olea europea (olive), Persea americana (avocado), Prunus spp. (including almond, apricot, cherry, nectarine, peach, plum), Pyrus communis (pear), Robinia pseudoacacia (black locust), Salix spp. (willows), Solanum tuberosum (potato), Vitis vinifera (grape), and various cereals, ornamentals, and weeds (Caballero V. 1972, Chiesa-Molinari 1942, Durán M. 1944, Olalquiaga-Faure and Contesse-Pinto 1959, González 1980, González et al. 1973). Given this host diversity, the true number of host species probably far exceeds the "more than 50" stated by González (1980).

Records cited for N. xanthographus from Eucalyptus sp. in Brazil (Menezes-Mariconi 1956), Ilex paraguariensis (mate) in Argentina (Bosq 1934), and "Myrtaceae" in Brazil (Bondar 1949) may apply to other members of the N. xanthographus group.

General Distribution

Confirmed or unchallenged records of N. xanthographus are from Argentina (various localities in the Provinces of Buenos Aires, Catamarca, Cordoba, La Pampa, Mendoza, and San Juan, south of the Rio Salado del Norte), Chile (immigrant, various localities from Maule Province in central Chile to Atacama Province in the

north), and Uruguay (Montevideo Province). Specimens tentatively identified as N. xanthographus which may represent other members of a species complex extend the range in Argentina southward to Chubut Province and northward through Salta Province to Paraguay and southern Brazil (States of Rio Grande do Sul and Santa Catarina). These tentative records are not included on the distribution map. Published records from the Argentinian Provinces of Corrientes and particularly Misiones (Bosq 1934) probably pertain to N. dissimilis Hustache. Published records of N. xanthographus from the southeasternmost Brazilian State of Rio Grande do Sul (Bertels 1953, 1954, 1962; Bondar 1949) are plausible but need confirmation. Records from farther north, notably from the State of Sao Paulo (Menezes-Mariconi 1956), may apply to Naupactus sp. "A".

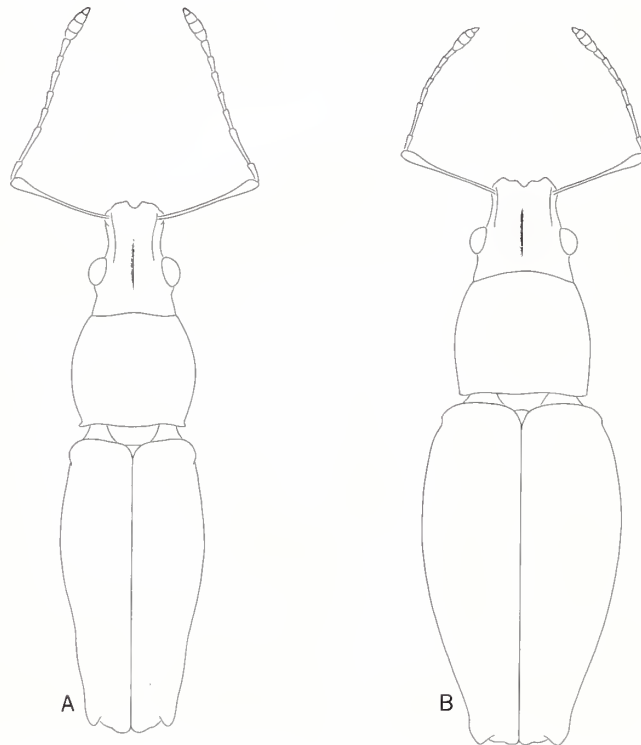


Naupactus xanthographus group distribution map. See N. "xanthographus" (sensu lato) for discussion of N. sp. "B", pages 7-8. (Prepared by Non-Regional Administrative Operations Office and Biological Assessment Support Staff, PPQ, APHIS, USDA).

Characters

Adult diagnosis. Naupactus xanthographus and N. dissimulator (Boheman) represent two closely related species groups which are somewhat difficult to place to genus in existing keys to Naupactini (van Emden 1944, Hustache 1947, Voss 1954; see O'Brien and Wibmer 1981 for additional references to published keys to Latin American weevils). For example, N. xanthographus is sexually dimorphic in several features, and in some characters (e.g. presence or absence of denticles on the ventral margin of the hind tibia) the two sexes might trace to different genera. However, the N. xanthographus and N. dissimulator groups are easily distinguished from all other Naupactini by having prominent posterior elytral tubercles (Fig. 1) formed by jointly swollen apices of intervals 3 + 9.

(Fig. 1)



Naupactus xanthographus adults, dorsal view: A. Male. B. Female
(Drawn by M. Ryan).

Naupactus xanthographus and most other members of the N. xanthographus group are distinguished from members of the N. dissimulator group by having the corbel (Fig. 2) of the hind tibia broadly enclosed, cavernous, and squamose, rather than very narrow or apparently open. Dorsal pronotal vittae (condensed bands of pale scales) are usually evident; members of the N. xanthographus group have a pair of vague to distant paramedian vittae, rather than a single, conspicuous median vitta as in the N. dissimulator group.

(Fig. 2)



Example of corbel in Graphognathus, apex of hind tibia.
A. Broad type - G. minor, B. Narrow type - G. peregrinus
(Both from Warner 1975).

Naupactus xanthographus is the southernmost member of a group of at least four, partly allopatric species or species complexes. Diagnostic characters are cited in the following key.

Key to Species of the N. xanthographus Group

1. Pronotum with paramedian vittae generally yellowish and darker than lateral vittae. Female antennal scape, not reaching front margin of pronotum (males not seen). Seen only from Sao Paulo State, Brazil. ALSO: Hind tibia with corbel broad and with 3 or 4 rows of scales. Posterior elytral tubercles feeble, not widely separated, sides of elytra not sinuate toward apex. Female elytra about 2.8-3.0 times as long as pronotum Naupactus sp. "A"
- 1'. Pronotum with paramedian vittae generally white or creamy and not darker than lateral vittae. Female antennal scape reaching at least front margin of pronotum (male scape proportionately longer). More southern, not seen from Sao Paulo State, Brazil 2

2. Male pronotum notably bulbous, elytra about 2.0-2.3 times as long as pronotum (about 2.3-2.5 times as long in females). Hind tibia with corbel narrow and with 1 or 2 rows of scales. Seen only from southern Brazil. ALSO: Posterior elytral tubercles prominent, widely separated, sides of elytra sinuate toward apex N. "mimicus" Hustache (sensu lato)

2'. Male pronotum not notably bulbous, elytra of N. xanthographus about 2.5-2.7 times as long as pronotum (about 2.6-3.0 times as long in females). (Males not seen for N. dissimilis; female elytra about 2.5 to 2.8 times as long as pronotum). Hind tibia with corbel broad and with 3 or 4 rows of scales. Seen from Argentina, southern Brazil, Chile, Paraguay, and Uruguay 3

3. Posterior elytral tubercles feeble, not widely separated, sides of elytra not sinuate toward apex. Elytra at base not sinuate just behind humeri, base not strongly bisinuate. Paramedian pronotal vittae strongly developed, scales not opalescent. Upper Rio Parana system of northern Argentina, southern Brazil, and Paraguay N. dissimilis

3'. Posterior elytral tubercles prominent, widely separated, sides of elytra sinuate toward apex. Elytra at base generally slightly sinuate just behind humeri, base generally strongly bisinuate. Paramedian pronotal vittae may be feebly developed, scales generally slightly opalescent. Widespread
. N. "xanthographus" (Germar) (sensu lato)

Comparative Notes on the N. xanthographus Group

Naupactus sp. "A", which may be N. navicularis Boheman, is represented in USNM and other collections examined, only by numerous female specimens from the State of Sao Paulo, Brazil. The record of N. xanthographus as a pest of Eucalyptus from the Piracicaba region of that State, cited and illustrated by Menezes-Mariconi (1956), refers to N. sp. "A", which is the only member of the N. xanthographus group known from Sao Paulo. Adult females of this species are readily distinguished from N. xanthographus by the relatively short antennal scape, pronotal color, and elytral structure.

The species or species complex herein identified as N. "mimicus" Hustache (= N. justus Bondar, fide Kuschel 1955) is perhaps confined to the upper Rio Parana, north of the Iguazu region of Brazil: western Parana (type locality of N. justus), "Minas Geraes" (single USNM female), and State of

Santa Catarina (type locality of N. mimicus). Specimens examined from Nova Teutonia, Santa Catarina, do not exactly fit the original descriptions of either N. mimicus or N. justus nor exactly match the Minas Geraes specimen; hence more than one species may be included among specimens keyed to N. "mimicus". Most records of the N. xanthographus group indicate the species are largely allopatric, but in Nova Teutonia, N. "mimicus" is sympatric with two morphs provisionally identified as N. xanthographus. Adults of N. "mimicus" are similar in elytral structure to N. xanthographus but are readily distinguished by their proportionately much larger pronotum.

Females of N. dissimilis Hustache resemble those of N. xanthographus except as explained in the key, and they are further distinguished from most N. xanthographus specimens by a more boldly contrasting scale pattern on the pronotum and elytra. However, specimens from parts of Paraguay and south-eastern Brazil tend to be intermediate between the two species or species complexes. According to Hustache (1947), males of N. dissimilis differ from those of N. xanthographus by having the elytral pattern reduced to a feeble sutural vitta. The general range is from the Rio Salado del Norte in Argentina, northward along the Rio Parana to perhaps the Iguazu Region. Records include: Argentina--various localities in the Provinces of Misiones (including female specimens in USNM perhaps from the same source as specimens from the type locality), Chaco and Santa Fe (Hustache 1947), and perhaps Corrientes (Bosq 1934, attributed to N. xanthographus); and Paraguay--Department of Alto Parana (Hustache 1947). Records of N. xanthographus from mate (Ilex paraguariensis) apparently pertain to N. dissimilis. Bondar (1949) cited specimens identified as N. navicularis from Santa Catarina as apparently conspecific with specimens of N. dissimilis, but the former may instead refer to the smaller, more boldly patterned morph of N. "xanthographus" from Nova Teutonia. Taxonomic revision of the N. xanthographus group is needed to resolve such questions.

Naupactus "xanthographus" (sensu lato) includes some records worth particular note. A form distinguished on the distribution map as N. sp. "B" is represented only by two specimens from Porto Alegre in the Brazilian State of Rio Grande do Sul. These specimens are distinguished from all others referred to N. "xanthographus" by having much coarser pale scales and thus a much more ashen appearance, and although they key to N. xanthographus, they may represent a distinct species. Specimens from Rio Grande do Sul reported by Bondar (1949) and Bertels (1953, 1954, 1962) as N. xanthographus may all have been from the Pelotas area, well south of Porto Alegre, and

might represent N. sp. "B", N. xanthographus, or intergrades. Farther north, at Nova Teutonia in the State of Santa Catarina, two morphs of N. "xanthographus" may represent distinct species. One of these probably is N. xanthographus, but the other has some features resembling N. dissimilis. Moreover, the distinction between N. dissimilis and N. xanthographus is unclear, as there are intermediate forms in some parts of Paraguay and southern Brazil. Thus, extreme northern specimens of the taxon distinguished here as N. "xanthographus" may represent several closely related species that need detailed taxonomic study. However, for quarantine purposes they should all be considered to represent N. xanthographus, as should any specimens that seem to key as intermediate between N. dissimilis and N. xanthographus.

Description of N. xanthographus

ADULTS - Mandibles conspicuously plurisetose and squamose, deciduous cusp or attachment scar at apex of anteriorly directed prominence. Mentum large, glabrous, maxillae concealed. Rostrum in front of eye much less than twice as long as wide, without transverse impression over antennal insertions, laterally bicarinate above; not separated from frons by transverse furrow or impression, frons and rostrum with narrow, deep longitudinal sulcus. Antenna with scape long, slender, extending well behind eye to about front margin of pronotum, with slender, appressed, setiform scales; funicle second segment much longer than first; club slender, nearly three times as long as wide. Eyes prominent, evenly convex, entirely lateral (frons wider than rostrum), not lying on distinct prominence, temples not or only feebly constricted behind eyes.

Pronotum widest near middle, about as wide as long (males) or distinctly transverse (females); without long ciliae or vibrissae at sides of front margin behind eyes; base feebly bisinuate, basal margin raised (not deeply bisinuate). Prosternum with coxal cavities contiguous, anterior and posterior intercoxal processes well separated; front edge of coxal cavity to front edge of prosternum much shorter than hind edge of coxal cavity to hind edge of prosternum. Scutellum triangular, not constricted by basal margin of elytron, with fine setiform scales. Elytra with basal margin feebly swollen (not strongly swollen or carinate), feebly bisinuate (not prominently bisinuate, not truncate nor conjointly concave or emarginate; caution--these distinctions are subtle!); flightless, humeri feebly developed (slightly more prominent in female), elytra usually slightly constricted behind humeri,

elytra across humeri conspicuously wider than base of pronotum; in dorsal view, elytra more strongly widened from base to about basal two-fifths in female than in male, margins slightly concave in front of apical tubercles; prominent apical tubercles formed by jointly swollen apices of intervals 3 and 9; elytral disc without erect setae, declivital region with short setae especially on sutural interval and apical tubercle.

Legs with femora not dentate or asperate ventrally, front femur slightly enlarged but not grossly incrassate in either sex; front tibia conspicuously denticulate and apically mucronate on ventral margin; middle and hind tibiae in female not or indistinctly denticulate on posteroventral margin, conspicuously but finely denticulate in male; apex of hind tibia with broadly enclosed, cavernous, squamose corbel, ascending comb of fine bristles about as long as apical width of tibia, glabrous tarsal grooves (posterodorsal articular surfaces); tarsal claws large, free (not basally connate). Abdomen with visible sternum 5 apically rounded, about as long as visible sternum 3 + 4 in female, apically slightly emarginate, much longer than visible sternum 3 + 4 in male.

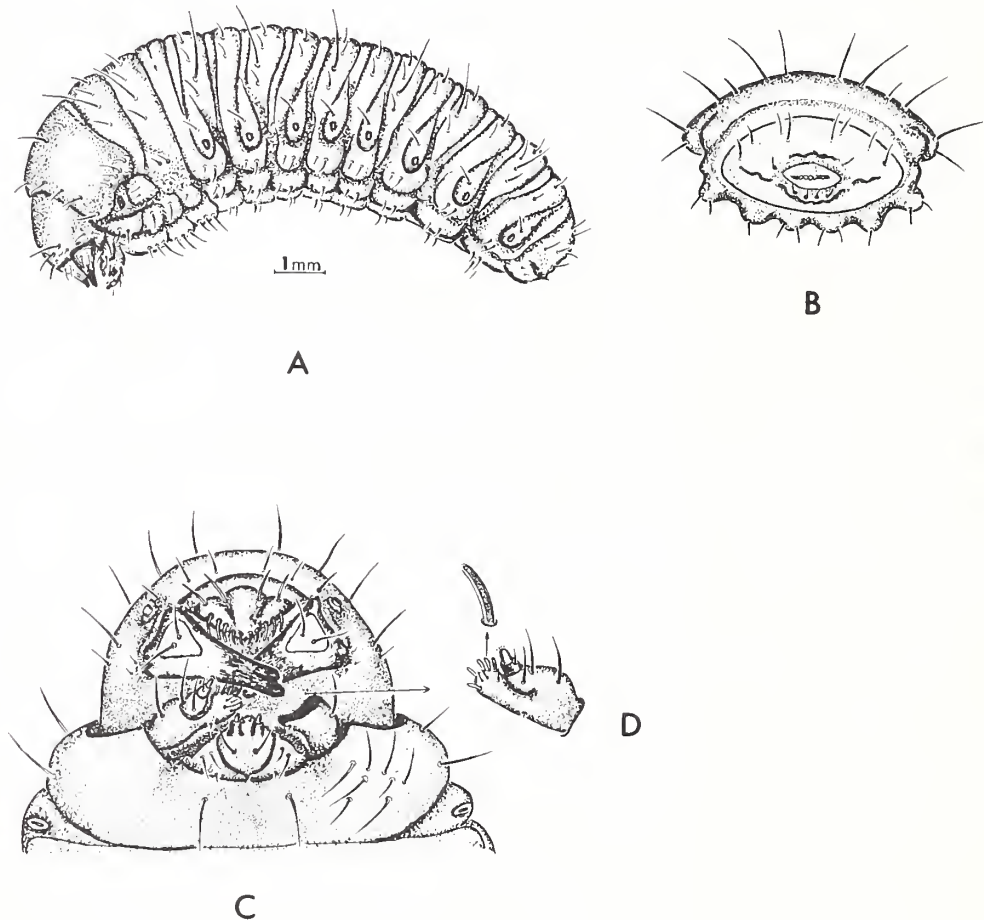
Length about 8 to 14 mm, females generally larger than males. Integument (in matured specimens) dark brown to nearly black. Dorsum incompletely concealed by ovate, grayish to brownish to slightly cupreous scales; feebly to distinctly developed pattern of paler scales on pronotum (feeble to distinct paramedian vittae pearly white, generally slightly opalescent; well-developed lateral vitta barely evident in dorsal view, generally broken at middle, creamy white to dark yellow, not opalescent) and elytra (whitish to cinereous to yellowish stripes on sutural interval from base to declivity, on basal third of interval 5, in arcuate vitta from humerus to about apical third of interval 5, and in some specimens in a short stripe near middle of interval 3).

EGGS - White, oval, diameter less than 1 mm.

LARVAE (Fig. 3) - Length 10-15 mm (Olalquiaga-Faure and Contesse-Pinto 1959). van Emden (1952) distinguished N. xanthographus larvae from those of certain other species of "Pantomorus": two species of Graphognathus, Atrichonotus taeniatulus (Berg); and Pantomorus (or Asynonychus) cervinus (Boheman). This reference should be consulted for help in larval identification ONLY to help detect possible immigrant populations in North America, especially for larvae found on roots of grape vines. Anderson and Anderson (1973) used a different set of characters and figures to distinguish the same

set of species, excluding N. xanthographus; this reference might also be consulted, for the same purposes. Identification of the immature stages of N. xanthographus is impractical since numerous other Naupactini in the same regions remain unknown or undescribed as immatures (D. M. Anderson, pers. comm.).

(Fig. 3)



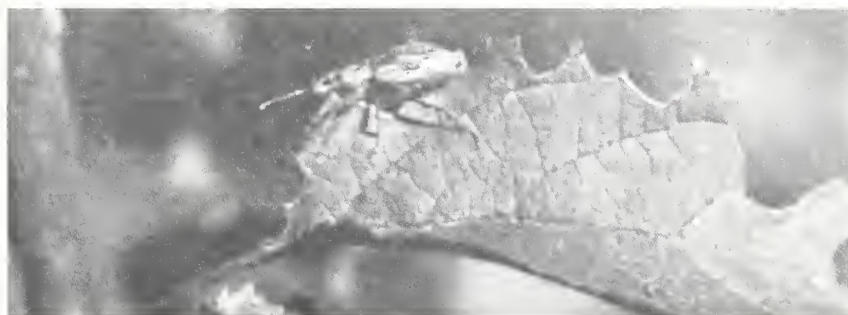
Naupactus xanthographus larva. A. Lateral view. B. Caudal view. C. Head, ventral view. D. Maxilla (From González 1983).

Characteristic Damage

Plants lack vigor. Several authors say plants die under continued attack, but González (1983) states that dead grape plants attributable to larval feeding have never been found.

Heavily infested grapevines are characteristically short and weak (Ripa-Sch. 1982). Leaf margins are notched (Fig. 4); in severe cases, only the main vein near the stem remains (Caballero V. 1972). Black sticklike feces cling to leaves, branches, and fruit. Bud and grape clusters are thin or absent. Primary roots show lesions, stop growing, and rot distally. Secondary roots are absent (González 1983).

(Fig. 4)



Naupactus xanthographus adult feeding on leaf (From Ripa-Sch. 1982).

Detection
Notes

Movement of infested fruit, plants, soil, or containers could introduce N. xanthographus into new areas. Citrus and grape plants are prohibited entry into the United States; other nursery stock is regulated entry. All soil must be removed from nursery stock as required under Title 7, Part 319.37, of the Code of Federal Regulations. Entry of fruits and vegetables is regulated, and most stone fruits and grapes from Chile require fumigation as a condition of entry because of various hitchhiking pests including N. xanthographus under Title 7, Part 319.56.

N. xanthographus adults have been intercepted 10 times at U.S. ports of entry with commercial shipments of Cucumis melo (melon), Malus sp. (apple), Prunus persica (peach), Pyrus communis (pears), and Vitis sp. (grape) from Chile in the past 13 years. Melons are not recorded as hosts in the available references. N. xanthographus was intercepted on Cupressus sp. (Italian cypress) from Costa Rica, a country which is not cited in the literature. This interception record may represent transshipments from other areas, or it may represent a misidentification.

This species may be detected in the following ways.

1. Look for the adults on grapevine shoots and leaves.
2. Search for larvae on grapevine roots.

Note: Adults are needed for positive identification.

Biology

N. xanthographus completes a generation in Chile in 19-20 months (Caballero V. 1972) although some workers believe less than 18 months (González 1983) is needed. Generations overlap, depending on the weather. Several stages of the insect are present at any one time (González 1983).

In some years, late-emerging and partly dormant adults occur into midwinter among weeds and alfalfa near gardens and vineyards. On cool mornings, adults shelter on trunks, branches, vines, or foliage until temperatures warm above 5-8° C. In 1980 when winter temperatures averaged over 11° C with minimums averaging 4-5° C, adults were common; some actively laid eggs in alfalfa fields. In colder winters, adults disappear in the coldest months (González 1983).

This species overwinters as larvae 15-80 cm deep underground (Olalquiaga-Faure and Contesse-Pinto 1959). Larvae take more than 12 months to complete development begun the previous year (Caballero V. 1968); the last active larval instars (fourth and fifth) require 6 months. By late spring and early summer, fifth instar larvae and pupae predominate in the mixture of immature stages infesting the root system (González 1983). Larvae undergo a sixth instar, the prepupal stage, before pupating in an earthen cell in the soil (Caballero V. 1972, González 1983).

The new adults emerging from these cells can remain in the soil for more than a month before emerging. Adults use their deciduous cusps to break through their cells and emerge above ground, beginning in early spring when the leaves unfold (González 1983). The adults cannot fly, so they disperse by crawling to their hosts or from field to field (Ripa-Sch. 1982). They feed voraciously on buds, green bunches of grapes, and leaves (González 1983). Emergence continues into fall with a peak in spring and a higher peak in summer (González 1983), Olalquiaga-Faure and Contesse-Pinto 1959, Ripa-Sch. 1982). The proportion of males tends to decrease toward the end of summer (Olalquiaga-Faure and Contesse-Pinto 1959). Individual adults live 4-5 months in spring, 2-3 months in summer, and 4-6 months in fall and winter (González 1983).

At least 4 weeks after emergence, males mature sexually. Mating continues from midspring until almost midfall. Fall females store sperm in their spermathecas for 3-4 months. In the laboratory, inseminated females laid fertile eggs from 3 weeks to 5 months after mating (González 1983).

Most egg laying occurs between midsummer and midfall and can continue through early winter. Individual females deposit eggs in gelatinous masses for 1-4 months (González 1983), laying an average of about 600 eggs (Ripa-Sch. 1982). They deposit eggs in crevices in the bark or beneath it, preferring the upper third of the plant, especially parts of branches closest to the trunk. In year-old vineyards, eggs were found at the base of the trunk or a few centimeters into the soil (González 1983). Eggs have also been found under vine stakes (Ripa-Sch. 1982).

Larvae hatch mainly from midsummer to the end of fall with a peak in fall. Some hatch into the end of winter (Gonzalez 1983). Larvae in the laboratory hatched at 25° C in 15-20 days (Ripa-Sch. 1982), but many did not hatch for 3-4 months. Newly hatched larvae can survive without food for 12 days (González 1983). After hatch, they drop to the ground, burrow into it rapidly, tunnel to the roots, and feed until the next year.

Acknowledgments

D. M. Anderson (Systematic Entomology Laboratory) provided information about larvae. Specimens examined included those in the USNM. Others were borrowed from T. H. de Araujo Arigony (Museu de Ciencias Naturais, Porto Alegre, RS, Brazil), A. T. Howden (Carleton University, Ottawa), and C. W. O'Brien (Florida A & M University, Tallahassee), all of whom also provided useful comment or criticism.

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